Energy Transformation & Conservation

Energy is a constant in the universe

Energy Transformation

Most forms of energy can be transferred into other forms. A change from one form of energy to another is called an energy transformation.

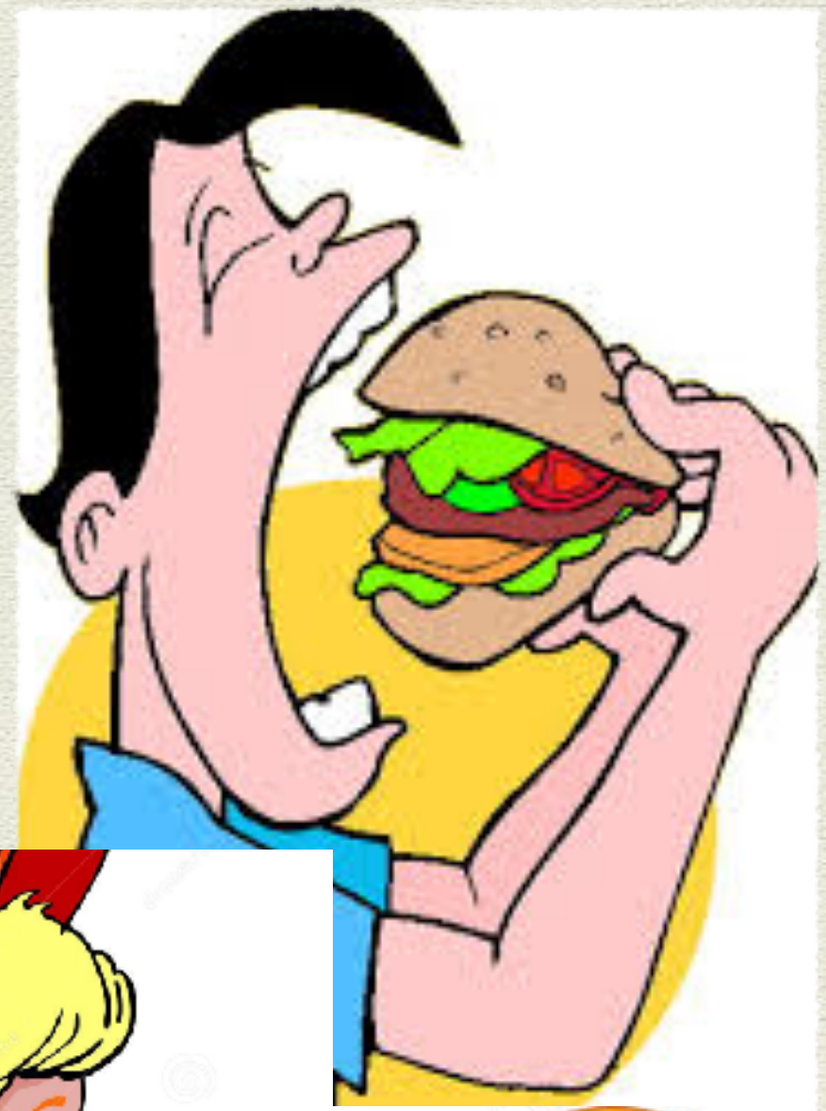
Some energy changes involve single transformations, while others involve many transformations.

Single Transformation

Sometimes one form of energy needs to be transformed into another to get work done. You are already familiar with many such energy transformations.

For example, a toaster converts electrical energy to thermal energy. A cell phone transforms electrical energy into electromagnetic energy that travels to other phones.

Your body coverts the chemical energy in the food you eat to the mechanical energy you need to move your muscles and to the thermal energy your body uses to maintain its temperature.



Multiple Transformations

Often, a series of energy transformations is needed to do work. For example, the mechanical energy used to strike a match is transformed first to thermal energy.

The thermal energy causes the particles in the match to release stored chemical energy, which is transformed to thermal energy and the electromagnetic energy you see as light.

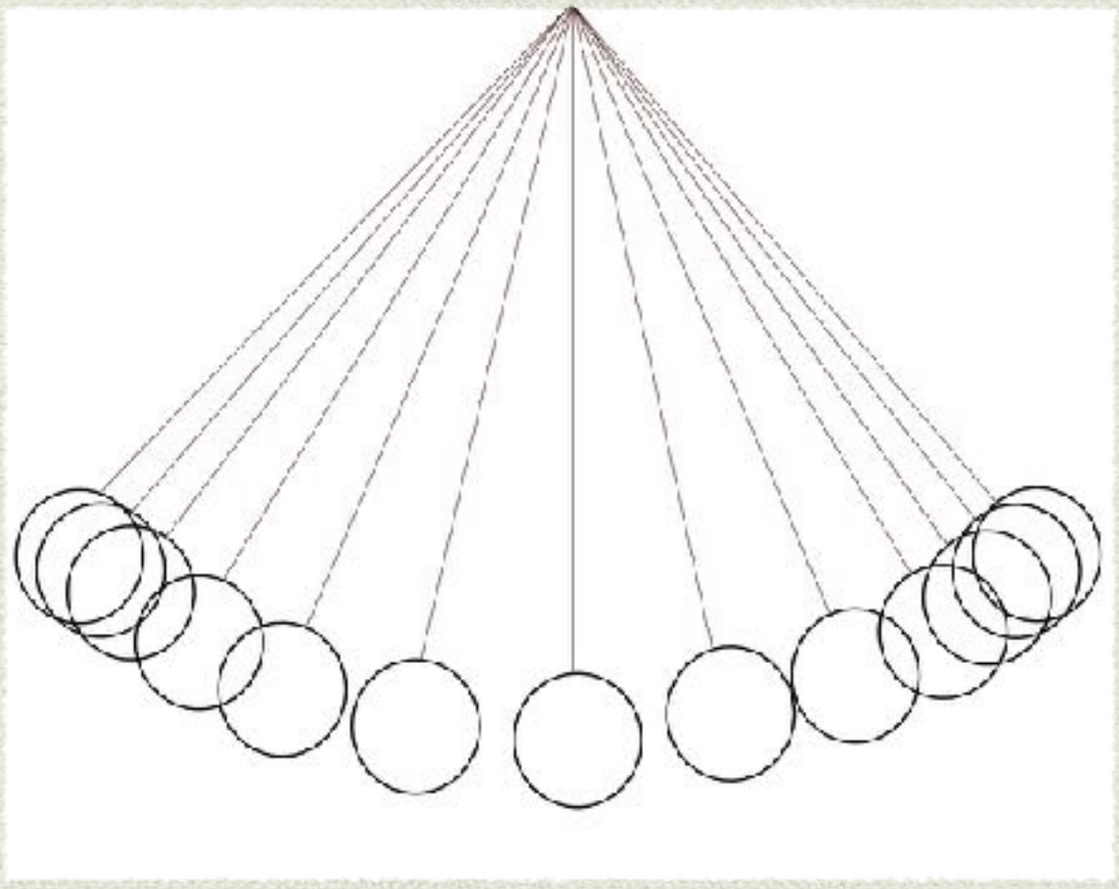
Energy Transformations in Juggling

Any object that rises or falls experiences a change in its kinetic and gravitational potential energy. Consider juggling an orange. When it moves, the orange has kinetic energy.

As it rises, it slows down. Its potential energy increases as its kinetic energy decreases. At the highest point in its path, it stops moving. Since there is no motion, the orange no longer has kinetic energy.

But it does have potential energy. As the orange falls, the energy transformation is reversed. Kinetic energy increases while potential energy decreases.

Energy Transformations of a Pendulum



In a pendulum, a continuous transformation between kinetic and potential energy takes place. At the highest point in its swing, the pendulum has no movement, so it only has gravitational potential energy.

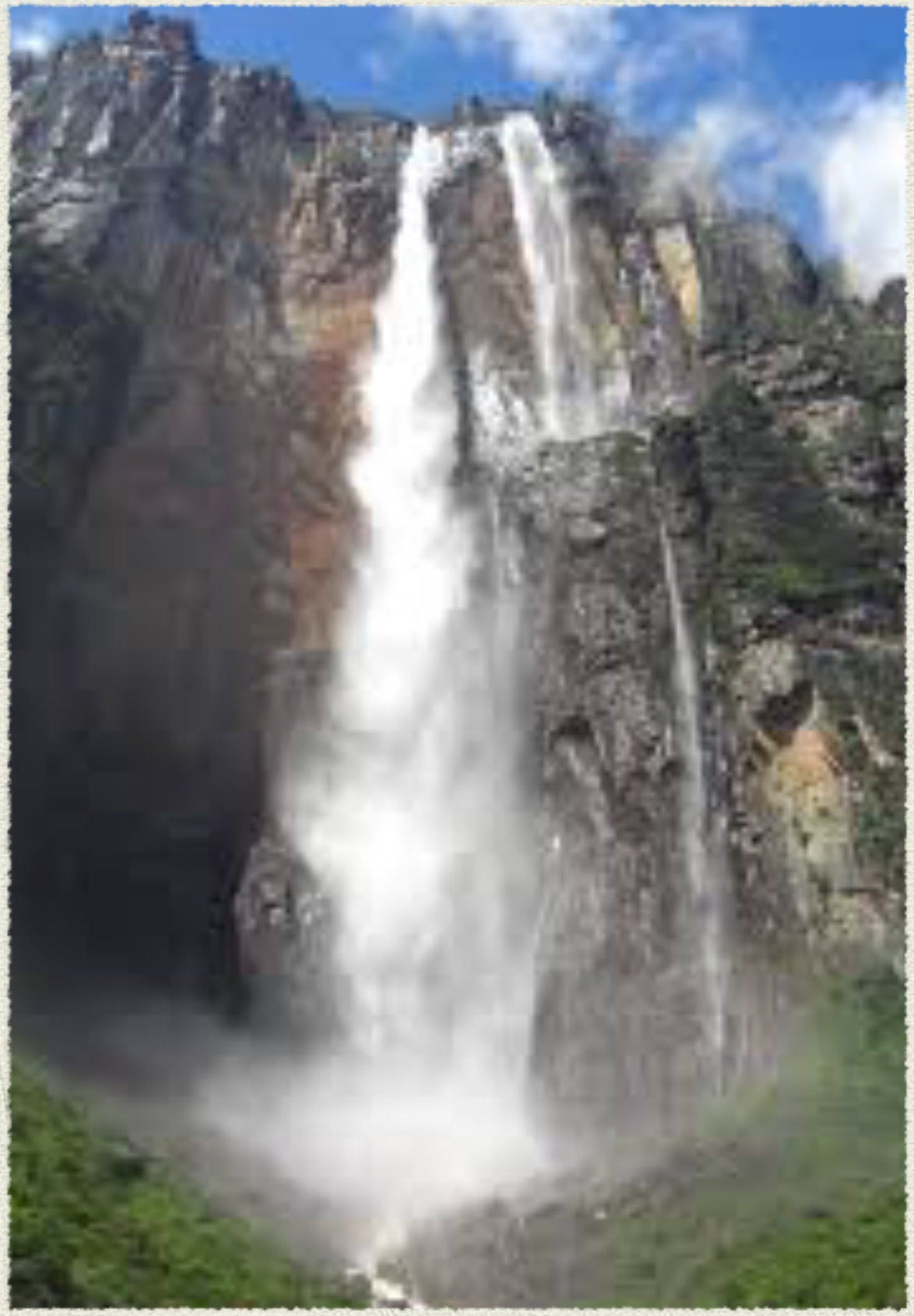
As it swings downward, it speeds up. Its potential energy is transformed to kinetic energy. The pendulum is at its greatest speed at the bottom of its swing. There, all its energy is kinetic energy.

As the pendulum swings to the other side, its height increases. The pendulum regains gravitational potential energy and loses kinetic energy. At the top of its swing, it comes to a stop again. And so the pattern of energy transformation continues.

Conservation of Energy

The law of conservation of energy states that when one form of energy is converted to another, no energy is destroyed in the process.

According to the law of conservation of energy, energy cannot be created or destroyed. This means that the total amount of energy is the same before and after any process.



For example, water at the top of a waterfall has gravitational potential energy. As the water falls, the potential energy decreases because the height decreases.

The kinetic energy increases because the velocity of the water increases. So potential energy is converted to kinetic energy.

The total amount of energy stays the same, it just changes forms.

Energy & Friction

What happens to the energy of a top? As the top spins, it encounters friction with the floor and friction from the air. Whenever a moving object experiences friction, some of its kinetic energy is transformed into thermal energy.

So, the mechanical energy of the spinning top is transformed to thermal energy. The top slows and eventually falls on its side, but its energy is not destroyed – it is transformed.

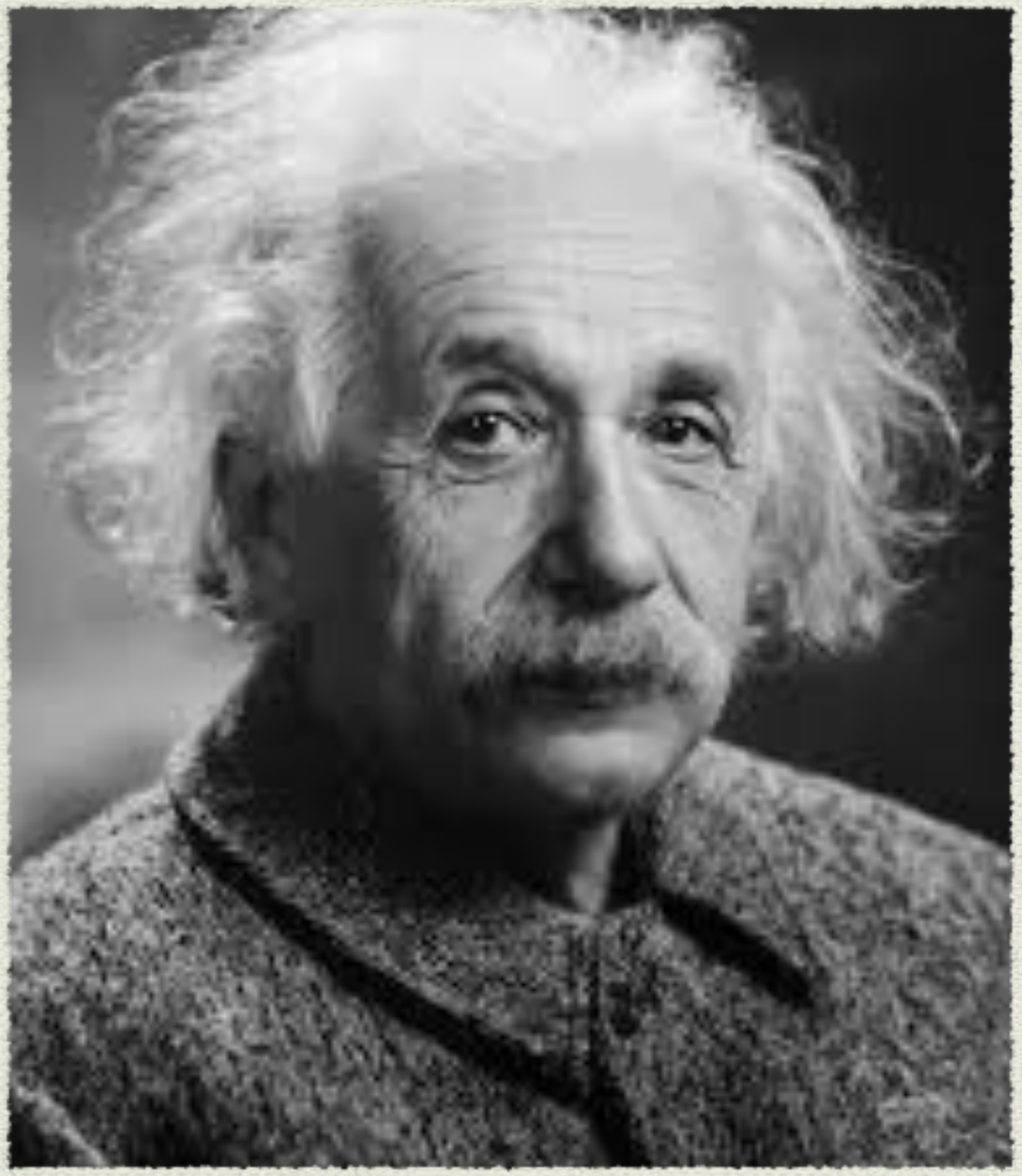
The fact that friction transforms mechanical energy to thermal energy should not surprise you.

After all, you take advantage of such thermal energy when you rub your cold hands together to warm them up.

Theory of Relativity

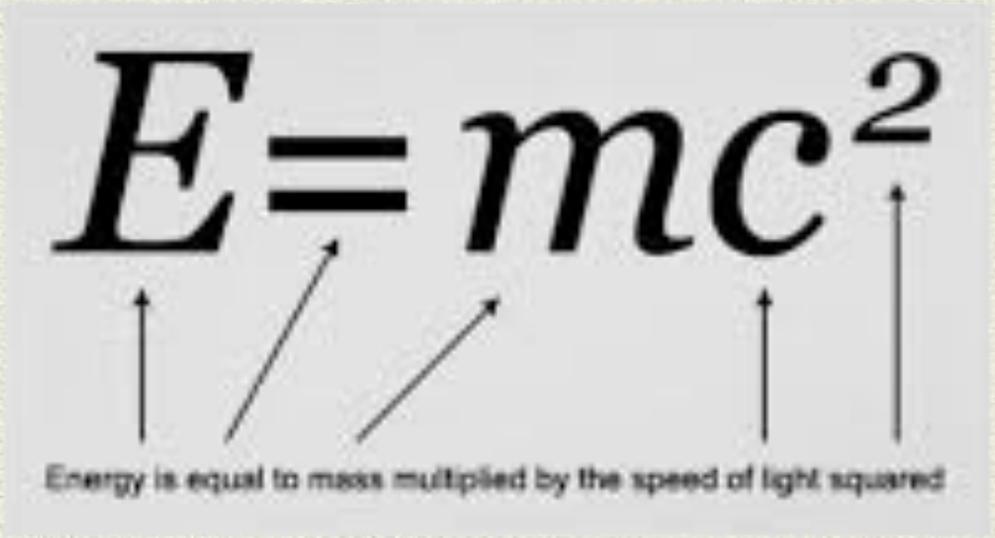
Albert Einstein was the creator of the Theory of Relativity. His theory stated that energy can sometimes be created by destroying matter. All objects are made of matter, which is anything that has mass and takes up space.

Einstein discovered that matter can be transformed to energy. Destroying just a small amount of matter releases a huge amount of energy.



Albert Einstein added an adjustment to the law of conservation of energy. He said that in the same way that different forms of energy can be transformed to one another, matter and energy can sometimes be transformed back and forth.

Matter and energy together are always conserved.



Keywords: English - Spanish

Law of Conservation of Energy - Ley de conservación de energía

Theory of Relativity - Teoría de la relatividad